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OCEAN FISHERY PRODUCTS AND THEIR INLAND TRANSPORT IN LESS DEVELOPED AREAS : A MULTI-DISCIPLINARY APPROACH FOR DELIVERY OF PROTEIN FROM THE SEA TO THE INLAND CONSUMER

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OCEAN FISHERY PRODUCTS AND THEIR INLAND TRANSPORT IN LESS DEVELOPED AREAS

(A multi-disciplinary approach for delivery of protein from the sea to the inland consumer)

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1. Large segments of the world's human population suffer continously from hunger and disease resulting from a severe dietary deficiency of animal protein. This is a serious condition that persists despite the fact that most of the protein-starved population centers are located in coastal regions to which the living bounty of the sea is available. Existing fishery resources off Southern Asia are only partially exploited and deep-sea fishing in the Arabian Sea, Indian Ocean, Bay of Bengal, South China Sea and the open Pacific is limited. In general, the harvest of fish in areas where protein starvation is greatest does no more than supply local demand; the actual yield falls far below the capacity of the stocks of fish and shell-fish that extend beyond the shore. What can be done to increase utilization of the many varieties of available marine food, to improve fish handling and processing facilities, and to provide efficient transport of fish protein to isolated inland markets? The purpose of this paper is to present a systems approach to what is essentially a complex interdisciplinary problem of supplying animal protein from the sea in the right form to the right place, and at reasonable prices.

Representative Problem Areas

2. Peru. For centuries, the ocean's wealth off the coast of Peru lay largely untapped by man. Aside from providing a meager subsistence to settlers on the shore, the sea's main contribution to human welfare was the fertilizer produced by seafowl who feed on marine life. In the past fifteen years, however, Peruvian fisheries have undergone a remarkable change. Production has increased from less than 50,000 metric tons in 1948 to more than 6,000,000 metric tons in 1962, and the end is not in sight. A fishing fleet of 1,000 modern mechanized vessels has been built, and more than 100 factories established for the processing of marine products. Expansion proceeds at such a rapid rate that there is actually a shortage of netting with which to equip the new ships.

3. This spectacular growth of the fishing industry has been a boon to the entire Peruvian economy. Fish products are now a major source of foreign exchange for the country, and thousands of workers have been employed in coastal regions that formerly

provided a marginal existence. Nevertheless, the precarious nutritional condition of several million people in the Andes, a short hour's airplane flight from port areas, has not been ameliorated significantly by the productivity of the sea. Some understanding of this seeming paradox can be gained from an examination of the following factors: (a) Implicit in the modernization process were ideas which required a long germination period before political and economic obstacles could be overcome and beneficial results obtained. (b) A substantial volume of the fish produce is exported in the form of fish meal. (c) Adequate transportation systems do not exist for the distribution of fish products from major centers of fish production to Peruvian towns and villages in the interior. This lack of efficient transport into the hinterland makes marketing costs prohibitively high when measured against local purchasing power. (d) Certain principal species of fish available in large quantities in Peruvian waters, especially ancheveta, are not particularly suitable for human consumption without substantial modification to please long standing tastes and preferences. (e) Certain technological problems involved in the production of protein concentrates from fish remain to be solved before the full potential can be realized as a cheap, acceptable staple in the diets of very low-income people. (f) Public health information and services have not yet established a public awareness of the importance of fish consumption in protein-deficient areas.

4. The Peruvian Government and specialized agencies of the U.N. are attempting to raise nutritional standards, and it is hoped that the results of their efforts will find application in other countries where similar problems exist.

5. West Africa. A concentration of population and an endemic disease vectored by the tsetse fly, which renders the raising of livestock impractical, are found in the tropical rain-forest belt that roughly parallels the West African coast from Guinea to the Cameroons. In this area incomes are very low and much of the economic activity, geared to a tribal society, is on a marginal subsistence basis. In no other area of the world is debility from protein deficiency disease more widespread or devastating in its effect on the people and economic progress.

6. Incongruously, the sea area adjacent to this belt of jungle and wooded savannah is one of the richest in the world, abounding in the pelagic fishes most relished by the people ashore who desperately require their nutritive value. This exasperating paradox of fish-eating people, close to unharvested stocks, importing fish at high cost, and still suffering from chronic protein shortages, is well known to West African leaders who seek satisfactory solutions to this age-old problem. The considerations involved, however, are considerably different from those in Peru, and include the following salient factors: (a) The local fishing industry is mostly in the canoe stage of development, with the result that thousands of skilled fishermen are severely limited in their range of operation and are at the mercy of the vagaries of current, wind and season. This condition results in gluts of fish when they are close inshore and drastic shortages when the schools move offshore beyond the limited reach of the fishermen. (b) The level of education, lack of technological development, and problems of transportation make it extremely difficult to accelerate badly needed improvements in fishery management and development. (c) The hot, humid climate causes high spoilage and greatly increases the problems of fish storage, transport and distribution, limiting the catch generally to immediate use in the landing area. (d) An extensive dried and smoked fish industry exists, but 25 to 50 percent of the product is destroyed by beetle larvae infestation. (e) Sociological factors must be carefully considered before attempts are made to modernize fish catching, processing and distribution. What would be the effect, for example, of the introduction of modern purse seiners on the social and economic life of coastal tribes?

7. Although it is known that marine resources are abundant in the Gulf of Guinea, fishery development has been impeded generally by a lack of knowledge of the relationships between ocean conditions and availability of commercially valuable aggregations

of fish. Oceanographic research conducted in the Gulf of Guinea and elsewhere in the Tropical Atlantic in the next two years should provide valuable guidance on improving the capabilities of harvesting fishery resources off the coast of West Africa.

8. India. In India a still different situation exists. Transportation facilities are generally superior to those of Peru or West Africa, and a higher level of technological skill is identified with the development of marine resources. Moreover, both seacoasts have abundant fish populations, especially the Indian Ocean. Yet we find the familiar pattern of a limited use of sea resources and widespread protein deficiency among the human population. Again we inquire: Why this particular anomaly in the midst of plenty? In India, the following factors are of major importance in the expansion of fish production: (a) The present government tends toward the philosophy that natural resources should not be exploited for personal gain. Therefore adequate profit incentives are not present to attract men and private capital into the risky venture of high sea fisheries. (b) Social traditions and religious beliefs engender negative attitudes towards both fishing as a means of livelihood and the acceptance of fish products for human consumption. (c) The lack of adequate harbors limits modern fishing vessel operations.

9. Southeast Asia. The coastal people of Southeast Asia are excellent fishermen who benefit from their long shore lines and plentiful supplies of fish. The inhabitants in general enjoy a strong fish flavor with their bland rice diet, and few social or religious beliefs bar the development of domestic fisheries. Although the fishing industry of the area has profited extensively from technical assistance from the U.N. (FAO) and other agencies, the vast majority of the people still do not receive animal protein in amounts adequate to supplement what is a predominantly vegetable diet.

10. Characteristic of the area are the familiar tropical problems of low-income consumers and a hot, humid climate that quickly spoils fish. The outstanding obstacle to a fuller use of fisheries is the almost total lack of facilities to transport fish products inland to dense population centers. The landings from small-scale fisheries typically are scattered over long stretches of the coast. Without an efficient transportation system, the costs of systematically collecting, processing, and marketing fish for inland distribution would be prohibitively high. The critical consideration in this instance is not simply that of providing new boats and gear to various fishing communities, but of bridging the distance between a landing and a hill village that may be only 10 miles away.

Requirements for Accelerated Development

11. The similarity of symptoms in these low-income areas masks a wide variety of underlying causes. There is no single magic formula for increased economic utilization of marine resources in coastal and inland areas since there is no single set of problems to be overcome. What is required is a unified method of analyzing the barriers to fishery development, and recognition of the need for biological, technological, economic, and engineering skills in fitting the several needs into a consistent, balanced program.

12. One road to fuller utilization of marine resources is to build, piece by piece, on the existing industry incorporating new technical processes and marketing methods in a program geared to the overall modernization process. It is a sound procedure but a slow one, and it drives home the fact that any expansion in the output and market outreach of fish is purchased only at the cost of lower production of other goods from which capital and skilled training are diverted.

13. The trade in fish is far from stagnant in these countries. Fresh, smoked, and dried fish move through well-developed small trader channels, and dried fish are handled in rather large volume. But at every stage the industry urgently needs modernization. Larger powered vessels are needed to handle modern gear and equipment. Processing losses and spoilage in the fish markets eat up an appalling part of the catch. Transportation routes and techniques are woefully inadequate, even for more durable commodities.

14. These areas are, in short, ready for change in their fishing and fish handling techniques. But the jobs to be done must be done simultaneously and with proper balance. The history of fishery development is littered with the wreckage of well-intentioned projects which did not take into account the impact of sudden increases in landings on inadequate transport, storage, and marketing facilities. Similarly, the introduction of modern technological methods in the various sectors of the fishing industry cannot be viewed apart from the total economic and social environment of which they are a part. Overall economic growth involves new industries and population concentrations and thus new targets for fishery products. Expansion in the use of fisheries is a complex matter of technological, organizational, and educational change that must be properly timed and analyzed to minimize economic and social costs.

15. To delve into the further complexities of sociological, religious, and political factors bearing on fisheries development would take us outside the scope of this paper. We cannot ignore them, however; if nothing else, technical and organizational improvements may create serious economic and social dislocation, particularly in nations still dominated by traditional modes of life. The pace of development must berelated to these considerations no less than to the direct costs of investment in new methods and facilities.

The Impact of Transportation on Fishery Development

16. Vital to the success or failure of fishery development programs is the degree of mobility and accessibility provided by regional and national transportation systems. Fishery projects and the speed with which they can be implemented to benefit protein-deficient populations are closely tied to the performance of existing port, terminal, inland waterway, road, rail and air transport facilities. Consequently, a detailed evaluation of the functional characteristics of the transport and distribution system must be an integral part of overall planning to promote maximum use of sea resources.

17. By bringing transportation into the planning process from the beginning, more rational choices can be made regarding the type, location and size of fish handling, processing and storage facilities, as well as appropriate methods of transport for fish distribution and marketing. The criteria for decision-making will need to take into account not only the relative cost and service function of alternative transport media, but other considerations relating to the volume of fish protein demand and supply by region, the restricted radius of markets, time in transit from producer to consumer, the demands for trained personnel, shipping hazards due to terrain or adverse weather, or the impact of different technologies on fishery and transport development. Countries of different sizes, topography, climate, and stages of economic growth obviously present a wide range of diverse problems and possibilities related to transportation and other major aspects of fishery development. In some areas, the relatively inexpensive extension of feeder roads to primary fish landings can bring extraordinary returns in the growth and concentration of marine fisheries. In other parts of the world, the use of inland waterways is a primary means of moving food supplies at low cost. In still others where difficult terrain hampers surface transportation, aircraft may effectively meet urgent consumer needs. But any attempt to arrive at physical and financial requirements for specific fishery projects must consider not only these interlocking relationships, but also the fact that existing organizational and administrative arrangements inevitably will condition transport services. Under the varying degrees of transport regulation, economic competition, and centralization, complex

problems will arise in the attempt to design an efficient transport network for delivery of fish products.

18. Particularly important are the advances in technology that will help reduce the drag of poor transport on fishery expansion. The new tools of systems analysis, conceptual mathematical models, and computer applications can extend the abilities of planners to analyze relevant data and predict the possible consequences of different courses of action. Interchangeable freight containers that can move through various types of carriers without breaking bulk from truck to rail, or rail to truck to barge offer possibilities for reduced cargo costs and greater protection of shipments against damage or adverse weather. Advances in the processing, preserving and storing of perishables could provide a wider dispersion of fish protein through the diminishing of peak load pressures on transport systems and the need for fast delivery. The development of mechanical refrigeration systems for trucks, trailers and container bodies has nearly eliminated spoilage losses in transit, and if the handling of frozen fish can be linked with the movements of other refrigerated commodities - meat, poultry and dairy products - the overhead costs borne by a fishing industry could be reduced. An example of this might be found in the Kenya-Uganda area of East Africa where a substantial traffic in frozen fish from the central lakes of Uganda and the coastal fisheries of Kenya inland to major population centers was made possible by a reverse flow of dairy products. Similarly, essential items such as nets, fuel and motor parts could be tied in to the carriage of non-refrigerated fish food. Changing technology can also have an impact in facilitating access to isolated areas through aircraft designed to take-off and land on short runways and configured to carry more cargo. Improvements in water transport efficiency may be realized through the introduction of diesel-powered tow boats and barges that can accommodate great volumes of freight at low cost. The potentials of transport innovations are thus essential ingredients of a total strategy for development and distribution.

Fish Protein Concentrates

19. Many of the marketing obstacles - the high cost of transportation and storage, the perishability and undependable quality of fish products - are directly related to the physical characteristics of traditionally processed marine foods. Similarly, processing limitations are at least partially responsible for the periodic gluts and scarcities so characteristic (and so discouraging to development) in the fish markets. Can more satisfactory processing methods be found which will yield safe, consistently uniform, high-quality protein concentrates from fish for use as supplements to deficient diets? If so, the impact on other essential operations in the flow of fishery products from sea to consumer would be immensely favorable. Elimination of the preservation bottlenecks would permit the harvesting of virtually all species of fish on a non-selective and less seasonal basis with significant increases in the physical and economic efficiency of fishing vessels and gear. Spoilage losses from hot, humid weather and infestation could be controlled at far lower costs, and basic market functions of transport, storage and retailing simplified considerably through obvious reductions in bulk and perishability. The overall effect would be a far wider dispersion of greater volumes of fish protein in diet-deficient areas.

20. Is the pursuit of this processing goal a dream, many years from solution? The authors do not think so. True, it appears at present that wholly flexible processes do not exist that result in fish products to suit all possible tastes and preferences. Yet we feel confident that the production of a safe and simple fish supplement which will be within the buying power of most low-income consumers is reasonably close at hand.

21. Today more than 20 nations are interested in the search for satisfactory fish protein concentrates. The Canadians have developed a product of exceptionally high

nutritive quality. The Union of South Africa has developed and tested a fish protein concentrate. UNICEF has actively cooperated with the Chilean government in the study of processing fish concentrates and a pilot plant is in operation. Researchers in other countries - Uruguay, Morocco, India, Russia, Norway, Sweden, Denmark, and Britain - also are actively engaged in the pursuit of satisfactory fish preservation methods. In the United States private industry has long been conducting processing studies, and the U.S. Government contemplates an extensive review of the problems associated with fish protein concentrate manufacture and use.

22. It should be repeated that the development of fish protein concentrates need not, and probably will not replace other methods of processing. There is, after all, no reason why individual tastes for fresh, dried, or canned fish cannot be satisfied. What is important is the stabilization of the overall market, the expansion of fishing effort which might be expected, and the extension of the dietary benefits of marine resources to areas and population groups otherwise hopelessly out of reach. The concentrates will present packaging, marketing, and consumer education problems of their own, of course, but they would raise far fewer problems than those encountered in expanding utilization of existing types of end-products.

Conclusions

23. In this discussion, it is implicit that the scale of any fishery development program must be closely tied to the existing resource base - human and physical - of the nations involved. Thus, a total strategy is required which will permit the accelerated use of marine food reserves but without incurring unnecessary or excessive allocations of scarce national resources. Regardless of the path chosen - building upon the traditional industry or introducing revolutionary change, or some combination of the two - the many critical factors which interact and constrain each other in fishery development require a broad-based, integrated approach to ensure their phased growth both as a systematic whole and in relation to the overall growth of the economy and society.

24. Today, the less developed countries are in a position where a rational choice can be made about the wide range of technological achievements available to them simultaneously rather than in a historical sequence as was the case in Europe and the United States. Scientific research has provided a better understanding of the distribution and movement of desirable fish species and improved techniques for their harvesting, processing and distribution. The future undoubtedly will bring many new improvements in the full use of the sea. Despite these advantages, a note of caution in the pace of development is suggested by the scarcity of reliable statistical data in most of the low-income countries, and the many examples of application of inappropriate technologies to emerging economies. Concern for the totality of the development problem is required to adapt scientific knowledge and techniques to the needs and aptitudes of a non-technological culture.

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